In June 1999, just before the enactment of the new local-to-local compulsory license in the SHVIA, the DBS industry had 10.1 million subscribers. 2000 Annual Assessment, ¶ 8. As of March 2005, the DBS firms have *25.7 million* subscribers.[6/] That this supercharged growth has been spurred by the availability of local-to-local is beyond doubt: the DBS industry's trade association has explained that over the past few years, "the availability of local services has been *a key factor driving the continued growth of DBS*." Comments of the Satellite Broadcasting & Communications Ass'n at 4, Dkt. No. 04-227 (filed July 23, 2004) (emphasis added).

### 3. SHVERA Explicitly Reaffirms And Strengthens Congress' Longstanding Preference For Local Over Distant Station Delivery

The philosophy behind the latest revision of the original SHVA – the Satellite Home Viewer Extension and Reauthorization Act of 2004 ("SHVERA") -- is captured in Section 204, which is entitled "Replacement of Distant Signals with Local Signals." This provision reiterates Congress' preference for local over distant signals in a variety of ways, including through implementation of the "if local, no distant" principle. For example:

- **Analog "if local, no distant" rule**: the Act prohibits signups of subscribers for distant *analog* signals if the satellite carrier offers *analog* local-to-local service to the subscriber, 47 U.S.C. § 339(a)(2)(C).

---

6/ Press Release, *The DIRECTV Group Announces First Quarter 2005 Results* (May 2, 2005), available at www.forbes.com/businesswire/feeds/businesswire/2005/05/02/businesswire20050502005455r1.html (DIRECTV had 14.45 million subscribers as of March 2005); Press Release, *EchoStar Reports First Quarter 2005 Financial Results* (May 5, 2005), available at www.forbes.com/businesswire/feeds/businesswire/2005/05/05/businesswire20050505005159r1.html (EchoStar had 11.23 million subscribers as of March 2005).

- **Digital "if local, no distant" rule**: the Act precludes new signups of subscribers for distant *digital* signals if the satellite carrier offers *digital* local-to-local service to that household, *id.*, § 339(a)(2)(D)(iv).

- **Analog local-to-local buythrough as prerequisite for receipt of distant digital signals**: the Act requires subscribers to purchase analog local-to-local service (if available) if they wish to receive a distant digital signal, even if they are tested and found to be unable to receive an over-the-air digital signal, *id.*, § 339(a)(2)(D)(iii)(III).

- **No testing of digital signals in markets with no analog local-to-local**: to encourage the further spread of local-to-local service, the Act provides for digital testing waivers in any DMA in which satellite carriers do not offer analog local-to-local service, *id.*, § 339(a)(2)(D)(viii)(VI).

- **No use of distant signals from another time zone to watch programming earlier than when it is broadcast locally**: the Act bars importation of distant digital signals from a time zone in which programming is broadcast earlier, such as delivery of the digital signal of the New York City ABC station to a viewer in San Diego or Missoula, *id.*, § 339(a)(2)(D)(iii)(I), 339(a)(2)(D)(v). It thus prevents use of the compulsory license to "scoop" local stations in the Mountain, Pacific, Alaskan, or Hawaii-Aleutian time zones with their own programming from distant signals.

- **No distant signals for "grandfathered" subscribers who receive local-to-local**: the Act bars delivery of distant signals to subscribers who were "grandfathered" by the 1999 SHVIA but who now receive local stations by satellite, 47 U.S.C. § 339(a)(2)(A)(i).

- **Grandfathering terminated for those not receiving distant signals as of October 2004**: the Act *ends* "grandfathering" for those subscribers who did not receive a distant signal as of October 2004, *id.*, § 339(a)(2)(A)(ii).

### B. Local-Into-Local Service Is Almost Universally Available Today, And Local Digital Signals Will Soon Be Available On DBS

EchoStar and DirecTV already offer transmissions the analog signals of local ABC, CBS, Fox, and NBC stations to nearly all U.S. television households -- and soon *all* local markets will have the option of receiving local programming from DBS. In this sense, no household in an analog local-to-local market is truly "unserved," regardless of the ambient field strength of the station's over-the-air digital signal near his or her home.

Ever since SHVIA was passed, DBS has rapidly rolled out local-into-local service across the country. Today, EchoStar *alone* reaches 155 markets, covering more than 95% of TV households, while DirecTV reaches 130 markets.[7/] Soon, DBS local-into-local service will be available everywhere: DirecTV has committed to offering local channels in all 210 markets as early as 2006 and no later than 2008.[8/]

In their local-to-local service, both DBS firms typically work with stations to obtain a direct feed from the stations' studios. The DBS firms then "digitize" the signals for retransmission to their customers.

---

7/ DIRECTV web site, www.directv.com; EchoStar Press Release *DISH Network Satellite Television Brings Local Channels to Billings, Mont.* (March 5, 2005).

8/ *See Memorandum Opinion and Order, In re General Motors Corporation and Hughes Electronics Corporation, Transferors, And The News Corporation Limited, Transferee, For Authority to Transfer Control*, ¶ 332, FCC 03-330, MB Docket No. 03-124 (released Jan. 14, 2004).

DirecTV and EchoStar often boast about the reception quality their subscribers can enjoy through their "digitized" analog local-to-local service. For example, DIRECTV tells customers that it "offers local channels in most major U.S. cities and their surrounding areas, *always in digital quality*," and EchoStar declares that its local-into-local programming is in "100% digital clarity."[9/] The result, according to the DBS industry's trade association, is that DBS "always delivers a *100 percent, crystal-clear digital audio and video signal.*" SBCA Web site, www.sbca.com/mediaguide/faq.htm <visited June 14, 2005> (emphasis added). The SBCA tells consumers that, unlike a signal delivered by cable, "[t]he quality of a digital signal beamed from a satellite to a dish is not subject to degradation and therefore, is a *superior quality signal.*" *Id.* (emphasis added).

Even as the DBS firms continue to expand their analog local-to-local offerings, they are simultaneously planning to roll out *digital* local-to-local. In September 2004, DirecTV announced plans to launch four new satellites through 2007 that would give it the capacity to carry up to ***1,500* HD local channels.**[10/] Since then, DirecTV has announced plans to offer local HD channels *this year* in at least 24 large markets that collectively cover *45%* of U.S. television households.[11/] The first 12 markets in which DirecTV will launch HD local-to-local are New

---

9/ *See* DIRECTV Local Programming FAQ (available at www.directv.com/DTVAPP/learn/FAQ_DTVProgramming_Local.dsp#1); www.dishnetwork.com/content/getdish/what_is/index.shtml.

10/ Press Release, *DIRECTV Announces Plan to Launch Next Generation Satellites to Provide Dramatic Expansion of High-Definition and Advanced Programming Services* (Sept. 8, 2004), available at http://phx.corporate-ir.net/phoenix.zhtml?c=127160&p=irol-newsArticle&ID=617918&highlight=. These plans by the DBS firms are logical, given the advantage their cable competitors currently enjoy from their local HD offerings.

11/ Press Release, *DIRECTV Spaceway F2 Satellite will Expand Local Digital/HD Services for DIRECTV Customers* (May 25, 2005), available at www.directv.com/DTVAPP/aboutus/headline.dsp?id=05_25_2005A.

York, Los Angeles, Chicago, Philadelphia, Boston, San Francisco, Dallas, Washington D.C., Atlanta, Detroit, Houston, and Tampa.[12/] *Id.* Once DIRECTV or EchoStar offers digital local-into-local in a particular market, of course, that firm will be barred from signing up new subscribers for *distant* digital signals, under the "if local, no distant" rules discussed above.

Although EchoStar has not announced detailed plans for offering digital local-to-local, the competitive pressure on EchoStar to do so will be intense, since its two principal competitors (cable and DIRECTV) are now offering, or will soon offer, HD local-to-local to the vast majority of U.S. television households. As discussed below, the Commission should take care not to endorse a system that would encourage EchoStar to use distant digital signals as a large-scale *alternative* to local-into-local service.

### C. The Commission Should Encourage the Growth of Digital Local-to-Local and Discourage Use of Distant Digital Signals As a Substitute for Local Signals

In the 1990s the DBS companies illegally delivered distant *analog* signals to millions of their customers.[13/] The Commission should keep that experience in mind as it considers the practical consequences of satellite delivery of distant *digital* signals. While DIRECTV is commendably making a major investment to offer local HD programming in markets across the country, EchoStar has signaled that it may make a much more limited investment in delivering

---

12/ Press Release, *New HD Local Markets Mark First Stage in Dramatic Expansion of HD Programming Over the Next Two Years* (Jan. 6, 2005) (available at http://phx.corporate-ir.net/phoenix.zhtml?c=127160&p=irol-newsArticle&ID=660037 &highlight=.

13/ *CBS Broadcasting Inc. v. PrimeTime 24*, 9 F. Supp. 2d 1333 (S.D. Fla. 1998) (entering preliminary injunction against DirecTV's and EchoStar's distributor, PrimeTime 24); *CBS Broadcasting Inc. v. PrimeTime 24 Joint Venture*, 48 F. Supp. 2d 1342 (S.D. Fla. 1998) (permanent injunction); *CBS Broadcasting Inc. v. DIRECTV, Inc.*, No. 99-0565-CIV-NESBITT (S.D. Fla. Sept. 17, 1999) (permanent injunction after entry of contested preliminary injunction); *ABC, Inc. v. PrimeTime 24*, 184 F.3d 348 (4th Cir. 1999) (affirming issuance of permanent injunction).

local digital and HD signals, at least in the near term. *See EchoStar Wants to 'See the Playing Field' Before Making HDTV and Broadband Bets*, Satellite Week (May 9, 2005) ("while HD 'on a national level is relatively economical, [the economics of] HD on a local level is still unknown'"); ("We're pretty sure that the top 20 markets make sense, but we're not sure about the 21st market, and we're definitely not sure if the 51st market makes sense.") (quoting EchoStar CEO Charlie Ergen).[14/]

There is a serious danger of history repeating itself: that is, that EchoStar will again try to use *national* feeds -- this time of the HD broadcasts of the network stations in New York and Los Angeles -- as an inexpensive way to deliver ABC, CBS, Fox, and NBC programming to large numbers of customers, rather than promptly investing in local-to-local HD service as its competitors have done.

As the record shows, EchoStar has no compunction about bending -- or breaking -- signal carriage rules. *CBS Broad., Inc. v. EchoStar Communications Corp.*, 276 F. Supp. 2d 1237, at ¶ 46 (S.D. Fla. 2003) ("EchoStar executives, including Ergen and [General Counsel] David Moskowitz, when confronted with the prospect of cutting off network programming to hundreds of thousands of subscribers, *elected instead to break Mr. Ergen's promise to the Court.*") (emphasis added); *see also EchoStar Satellite Corp. v. Brockbank Ins. Servs., Inc.*, No. 00-N-1513, at 23 (D. Colo. Feb. 5, 2004) (EchoStar's actions "rose to the level of conscious

---

[14/] As to the Mr. Ergen's stated doubts about EchoStar's ability to offer digital local-to-local: in 2002 the two DBS firms claimed that unless they were permitted to merge, neither firm could offer local-to-local in more than about 50 to 70 markets. *EchoStar, DirecTV CEOs Testify On Benefits of Pending Merger Before U.S. Senate Antitrust Subcommittee*, www.spacedaily.com/news/satellite-biz-02p.html ("Without the merger, the most markets that each company would serve with local channels as a standalone provider, both for technical and economic reasons, would be about 50 to 70."). Since EchoStar alone now offers local-to-local service in *155* markets, the Commission should be skeptical of its current claims that it would be difficult (or uneconomical) to offer digital local-to-local in a large number of markets.

wrongdoing"); *National Association of Broadcasters and Association of Local Broadcasters Request for Modification or Clarification of Broadcast Carriage Rules for Satellite Carriers*, Declaratory Ruling and Order, DA 02-765, ¶ 37 n.116 (released April 4, 2002) (collecting examples of EchoStar misconduct in Commission proceedings).

As the Commission considers possible recommendations about carriage of distant *digital* signals, therefore, it should keep in mind the need to prevent the recurrence of past DBS industry abuses of distant signals.

## III. THE COMMISSION'S PLANNING FACTORS FOR DIGITAL SERVICE

As we show here, the present proceeding is intimately related to, and for powerful policy reasons must be consistent with, the Commission's decisions over the past decade concerning the transition from analog to digital television broadcasting, including most notably the planning factors that the Commission relied on in making digital channel assignments.

### A. The Commission's Use of Planning Factors to Determine the Minimum Signal Strength Needed to Receive Over-the-Air Analog and Digital Signals

In planning the analog television system decades ago, and in devising the digital television system much more recently, the Commission needed to determine how strong a signal is required to receive a television picture. In each case, the Commission has used a formula based on a set of "planning factors," that is, assumptions about a variety of technical issues, including about the types of equipment that would be used in the "receive" setup, *i.e.*, by consumers at their homes.

In previous proceedings under SHVA and its successor laws, the Commission has carefully reviewed the *analog* planning factors and endorsed the long-standing definition of "Grade B intensity" for analog signals (*e.g.*, 47 dBu for low-VHF channels). *E.g.*, *Satellite Delivery of Network Signals to Unserved Households for Purposes of Satellite Home Viewer Act*,

Report and Order, FCC 99-14 (released Feb. 2, 1999). The Commission has also evaluated the antennas and other equipment available to consumers and concluded that the analog planning factors make realistic assumptions about what steps consumers can be expected to take to receive over-the-air signals. *See id.*; *In Re Technical Standards for Determining Eligibility for Satellite-Delivered Network Signals Under the Satellite Home Viewer Improvement Act*, ET Dkt. No. 00-90, ¶¶ 33-56 (released Nov. 29, 2000).

To implement digital television and to make digital channel assignments, the Commission developed a similar set of planning factors to determine the minimum signal strengths -- in dBu's -- that are the digital equivalent of "Grade B intensity" for analog. As it did with the analog planning factors, the Commission again had to make assumptions about the types of equipment that consumers can reasonably be expected to acquire to obtain over-the-air TV signals. For example, as with the analog planning factors, the Commission's DTV planning factors assumed an outdoor antenna with substantial gain.

In predicting the expected service areas of digital TV signals -- using the Longley-Rice propagation model -- the Commission likewise had to make assumptions about consumer reception equipment. As the Commission explains in its Notice of Inquiry in this proceeding, the procedures the Commission has used in predicting expected digital service areas "presume that households will exert similar efforts to receive DTV broadcast stations as they have always been expected to exert to receive NTSC analog TV signals." NOI, ¶ 6.

Based on the analog and digital planning factors, the Commission's rules (Sections 73.622(e)(1) & 73.683(a)) specify the following minimum signal strengths for analog and digital service:[15/]

| Channel Numbers | Channel Label | Minimum Analog Field Strength (dBμV/m) | Minimum Digital Field Strength (dBμV/m) |
|---|---|---|---|
| 2-6 | Low VHF | 47 | 28 |
| 7-13 | High VHF | 56 | 36 |
| 14-69 | UHF | 64 | 41 |

As explained in the Engineering Statement of Meintel, Sgrignoli & Wallace (Attachment 1 hereto), the minimum field strengths for DTV are derived from the planning factors shown in the following table:

15/ While OET Bulletin 69 provides for slight variations in the UHF minimum field strength, based on the dipole factor, the Commission's regulations specify the *specific* dBu levels indicated in the text, including for UHF. In the SHVERA, Congress specifies that the specific dBu levels mentioned in the regulations shall be used in determining whether households are considered "unserved." *See* 17 U.S.C. § 119(d)(10)(A) (incorporating analog signal strength figures from Section 73.683(a)) and 47 U.S.C. § 339(a)(2)(D)(vi)(I) (incorporating digital signal strength figures from Section 73.622(e)(1)).

| Planning Factor | Symbol | Low VHF | High VHF | UHF |
|---|---|---|---|---|
| Geometric Mean Frequency | F | 69 | 194 | 615 |
| Dipole Factor nominal (dBm-dBμ) | $K_d$ | -111.8 | -120.8 | -130.8 |
| Dipole Factor adjustment | Ka | None | None | See text |
| Thermal Noise (dBm/6 MHz) | $N_t$ | -106.2 | -106.2 | -106.2 |
| Antenna Gain (dBd) | G | 4 | 6 | 10 |
| Antenna Front/Back Ratio (dB) | FB | 10 | 12 | 14 |
| Downlead Line Loss, 50' cable (dB) | L | 1 | 2 | 4 |
| System Noise Figure (dB) | $N_s$ | 10 | 10 | 7 |
| Required Carrier Noise (dB) | C/N | 15 | 15 | 15 |
| Calculated Minimum Rx Power (dBm/6 MHz) | $P_{min}$ | -81 | -81 | -84 |

### B. The Assumptions Made in the Commission's DTV Planning Factors and in the Longley-Rice Model About Household Reception Equipment Are Reasonable and Realistic

Because the topic is germane to many of the specific questions raised by the Commission in its Notice of Inquiry in this proceeding, we show here that the Commission's assumptions about consumer equipment for DTV reception are entirely reasonable.

**1.** Rooftop vs. indoor antennas. The Commission asks whether it should assume, for purposes of implementing SHVERA, that consumers use a *rooftop* antenna or instead an *indoor* antenna. NOI, ¶ 7. The answer is plain: the Commission should assume use of a rooftop antenna.

**a.** Indoor antennas perform much less well at receiving over-the-air TV signals. As the Notice of Inquiry observes, the reception characteristics of indoor antennas are much worse than those of outdoor rooftop antennas. *E.g.*, NOI, ¶ 20 ("indoor-mounted antennas will generally receive weaker signals than outdoor-mounted antennas"). In particular:

- **Indoor antennas have lower gain**: As recent tests confirm, indoor antennas have much less gain than good outdoor antennas, and in some cases actually deliver a *weaker* signal than a reference dipole (*i.e.*, the indoor antenna has a "loss," not a gain). *See* Kerry W. Cozad, *Measured Parameters for Receive Antennas Used in DTV Reception* (Attachment 2 hereto).

- **The location of indoor antennas is much worse for reception of over-the-air signals**: An indoor antenna is placed at a location inside a building and below -- sometimes much below -- the location of an outdoor rooftop antenna. This location hurts the antenna's performance in two ways: the lower height usually means reduced signal strength, and placement behind walls (sometimes multiple walls) translates into still lower ambient field strength. MSW Engineering Statement, ¶ 38.

- **Indoor antennas are typically nondirectional**: Indoor antennas are usually nondirectional, and therefore more prone to problems from both multipath and interference. *Id.*

- **Indoor antennas are affected by the motions of people in the room**: Because indoor antennas are so close to the viewers, they can easily be affected by the changing positions of people in the room, which can radically alter the antenna's reception pattern. *Id.*

Because rooftop antennas are so much better than indoor antennas, households have long used rooftop antennas to achieve over-the-air reception, particularly if the household is at some distance from the transmitting tower. In fact, rural households often rely on small towers -- with over-the-air antennas considerably *higher* than rooftop level -- to receive a strong signal from stations several dozen miles away. MSW Engineering Statement, ¶ 39.

b. *Satellite* antennas work only outdoors, and are usually placed on the rooftop. This proceeding is about how *satellite subscribers* can receive over-the-air digital signals. But when those same subscribers wish to receive signals from DIRECTV or EchoStar, they use a satellite reception antenna (popularly known as a satellite dish) that *can only be used outdoors*, and usually on a rooftop. An "indoor" satellite antenna would be useless. It would be egregiously discriminatory to conclude that while satellite subscribers are expected to rely on a rooftop antenna for their satellite reception, they cannot be expected to do the same to pick up over-the-air signals.

c. The Commission's digital transition proceeding has always assumed use of a rooftop antenna. The Commission's entire digital transition effort – assigning digital channels to TV stations, determining their coverage area, replicating analog coverage areas, and assessing the power levels at which the stations should operate -- has been based on the assumption that consumers are using rooftop receiving antennas to receive DTV signals. *See* NOI, ¶ 6. It would be totally unfair -- and without any rational basis -- for the Commission to now treat households as "unserved" by digital signals, and allow importation of duplicative signals from other cities, based on the new premise that households even 50 miles from TV towers use only *indoor* antennas. Such an eleventh-hour change would be like telling hurdlers, as they line up for the final race of the Olympics, that the officials have decided to raise the height of the hurdles by two feet.

Had the Commission assumed use of indoor antennas in planning the digital transition, that process would have been radically different. For example, to replicate analog coverage areas (which have always been premised on outdoor antennas), the Commission would need to have authorized stations to transmit their digital signals at enormously higher power levels to

reach *indoor* antennas 50 or 60 miles away. Those vastly higher power levels, in turn, would have required completely different interference calculations. MSW Engineering Statement, ¶ 9. Having correctly rejected -- throughout the digital transition -- the assumption that consumers use only indoor antennas, and having encouraged broadcasters to build out their digital facilities based on outdoor antennas, it would be an abuse of discretion for the Commission suddenly to reverse course now.

**d.** **Proper vs. improper antenna orientation**. The Commission asks whether it should assume that the over-the-air antenna is properly oriented to achieve the best reception from the station in question. NOI, ¶ 7. Again, it is essential to assume proper orientation. In particular:

- **Assuming improper orientation would be discriminatory and unfair.** As with the issue of rooftop vs. indoor antennas, it would be exceedingly discriminatory to assume that a DBS household's over-the-air antenna is *improperly* oriented when the same household's satellite antenna must be *precisely oriented* towards the satellite to get any signal at all. In addition, as discussed above, the entire digital transition has been premised on the assumption that consumers will use properly-oriented rooftop antennas to receive digital TV signals. *E.g.*, Notice of Inquiry, ¶ 10 (process used by the Commission in assigning digital channels assumes that receive antenna "is oriented in the direction which maximizes the values for field strength for the signal being measured."). Similarly, SHVA and its successors have always assumed that a household's ability to receive an analog signal assumes use of a properly-oriented directional antenna. *See, e.g., In Re Technical Standards for Determining Eligibility for Satellite-Delivered Network Signals Under the Satellite Home Viewer Improvement Act*, ET Dkt. No. 00-90, ¶¶ 33-36 (released Nov. 29, 2000). For the same reasons

it would be unfair to suddenly assume an *indoor* antenna for purposes of evaluating the availability of a digital signal in this context, it would be unfair to assume that the household's *outdoor* antenna is improperly oriented.

- **TV towers are co-located in many markets**. Although consumers can reasonably be expected to orient their over-the-air antennas correctly in any market, it will often be possible for consumers to do so with a single, fixed antenna, because the TV transmitters in many markets are co-located. In these cases, there will be no need for a rotor. MSW Engineering Statement, ¶ 44.

- ***Special antennas for non-co-located towers***. In markets in which TV towers are located at different sites, local electronics installers sometimes offer a special antenna designed to receive signals from two different directions, again without the need for a rotor. *Id.*

- **Rotors are readily available at modest cost**. For those instances in which the options just discussed are not available, consumers can acquire, at modest cost, a rotor that enables a rooftop antenna to be moved to achieve the best signal from a particular station. Manufacturers today sell not only basic rotors but new, sophisticated models that offer features such as remote control operation. For example, the CM 9521A manufactured by Channel Master (sold by Solid Signal for only $68.99) includes a remote control that allows television viewers to select the proper orientation to receive a particular station simply by keying in that station's channel. *See* www.solidsignal.com/prod_display.asp?main_cat=03&CAT=&PROD=MTRTR200#MORE.

e. **Antenna gains**. In its digital planning factors, the Commission assumes use of a receiving antenna with gains of 4 dB for low-VHF, 6 dB for high-VHF, and 10 dB for

UHF. As discussed in greater detail by the Network Affiliates in their Comments, a wide variety of rooftop antennas are available at reasonable prices with these or greater gains.

The Commission has "long recommended that consumers in outlying or difficult reception areas use *separate* UHF and VHF outdoor antennas, which provide better performance on UHF than a combination UHF/VHF antenna, at little or no additional cost." *In Re Technical Standards for Determining Eligibility for Satellite-Delivered Network Signals Under the Satellite Home Viewer Improvement Act*, ET Dkt. No. 00-90, ¶ 32 (released Nov. 29, 2000) (emphasis added). As the Network Affiliates discuss in their Comments, separate UHF and VHF outdoor antennas can easily be purchased at moderate expense to achieve gains better than those assumed in the DTV planning factors. That fact alone means that the DTV planning factors already contain a substantial "safety margin."

For the Commission's convenience, in these Comments we show that even if a consumer prefers not to use separate antennas, he or she can easily obtain (1) a *single* antenna (the Channel Master 4228, costing $39) that exceeds (or is very close to) the DTV planning factors across all channel bands, or (2) a single, attractive, relatively small antenna / preamplifier combination (the Winegard SquareShooter SS-2000, costing about $100) that will substantially exceed the performance assumptions in the DTV planning factors.

As recent empirical tests show, the Channel Master 4228 achieves gains that are at least as good as, and in some cases better than, those assumed in the DTV planning factors. Kerry W. Cozad, *Measured Parameters for Receive Antennas Used in DTV Reception* (Attachment 2 hereto). Specifically, the Channel Master antenna achieves gains of about 14 or 15 dB for most UHF channels, while the planning factors call for a gain of only 10 dB for UHF. Similarly, for

high-VHF, the Cozad paper shows that the Channel Master antenna achieves gains of about 8 or 9 dB, compared to the assumption in the planning factors of only 6 dB of gain.

Even for low-VHF -- a channel range in which very few network affiliate stations will broadcast in digital -- the Channel Master 4228 antenna offers gains nearly as high as those specified in the DTV planning factors. (In the relatively unusual case of a household located at the fringe of the coverage area of one of the few low-VHF DTV stations, one can either use a preamplifier with this antenna, or use a separate VHF antenna, to deliver results far above the planning factors for VHF.) The Channel Master antenna is available for as little as $39. *See* Solid Signal web site, www.solidsignal.com/prod_display.asp?main_cat=03&CAT=&PROD=ANC4228.

Another option is the Winegard SquareShooter 2000, a small, attractive directional antenna with a preamplifier. Although the manufacturer states that the antenna alone has a gain of 4.5 dB for UHF (below the planning factor assumption), the combined setup *with* the preamplifier far exceeds the planning factors. MSW Engineering Statement, ¶ 46. The SquareShooter 2000 is available for $98.99. *See* www.solidsignal.com/prod_display.asp?main_cat=3&CAT=&PROD=SS-2000.

**f.** **System noise figure**. The Commission's planning factors assume a system noise figure of 10 dB for VHF channels and of 7 dB for UHF channels. While there is little published data about receiver noise figures, consumers can in any event make the noise figure of the receiver irrelevant -- and achieve many other benefits -- with an inexpensive preamplifier.

**g.** **Use of low-noise amplifier (or "preamplifer")**. Although not included in the DTV planning factors, consumers can easily do much *better* than the DTV planning

factors by using a low noise amplifier (LNA), or "preamplifier," mounted on the mast that holds the rooftop antenna. As explained by Meintel Sgrignoli & Wallace, a preamplifier offers several different advantages, that cumulatively can add at least 12-15 dB of effective gain -- and sometimes much more -- to the consumer's system.

Low-noise amplifiers are readily available at a modest price: Meintel Sgrignoli & Wallace identify four highly effective low-noise amplifiers that range in price from $56.99 to $164.00. MSW Engineering Statement, ¶ 50 and Table 5. Because of their benefits and low cost, consumers in locations where signal strength may be marginal often use preamplifiers to boost reception. As Meintel Sgrignoli & Wallace explain, "[t]he availability of . . . preamplifiers . . . provides a substantial 'cushion' against the possibility of losses not specifically accounted for in the planning factors, including impedance mismatches and additional attenation from signal splitters." MSW Engineering Statement, ¶ 51.

**h.** **Downlead line loss**. As the planning factors recognize, a certain degree of signal loss occurs as the signal is transmitted from the rooftop antenna through a cable to the household's television equipment. The extent of the loss depends, of course, on the type of cable used. EchoStar recommends use of RG-6 coaxial cable as the downlead for satellite signals,[16/] and it is reasonable to assume use of that same type of cable for the off-air signal downlead. *See In Re Technical Standards for Determining Eligibility for Satellite-Delivered Network Signals Under the Satellite Home Viewer Improvement Act*, ET Dkt. No. 00-90, ¶ 28 (released Nov. 29, 2000) ("there is no serious question that RG-6 is clearly the preferred and recommended choice that consumers residing near the Grade B contours of TV stations would typically employ").

---

16/ EchoStar web site, www.dishnetwork.com/content/products/installation/index.shtml.

The DTV planning factors assume downlead line losses of 1 dB for low-VHF, 2 dB for high-VHF, and 4 dB for UHF. According to the specifications published by two major manufacturers of RG-6 cable, the actual line losses are lower than those assumed in the planning factors. MSW Engineering Statement, ¶ 53. It is therefore reasonable to assume that consumer downlead losses will be no greater than -- and often less than -- those specified in the DTV planning factors.

i. **Front-to-back ratio**. For DTV, the Commission's planning factors assume that the consumer's receiver antenna has a front-to-back ratio of 10, 12, and 14 dB for low-VHF, high-VHF, and UHF, respectively. These ratios are readily available in consumer equipment; for example, the Channel Master 4228 rooftop antenna (which costs $39) does considerably better than the planning factors assume, with a front-to-back ratio of roughly 25 dB for VHF and 18 db for UHF. *See* MSW Engineering Statement, ¶ 47.

j. **Conclusion with respect to DTV planning factors**. Even if they choose not to take advantage of the benefits of a preamplifer, consumers can easily acquire, at relatively modest expense, reception equipment that is in line with -- or somewhat better than -- what the DTV planning factors assume. If the consumer chooses to use a preamplifer, he or she can easily have a reception setup that is *much superior* to what the DTV planning factors assume. Particularly since satellite subscribers must pay roughly $6 per month ($72 a year, or hundreds of dollars in just a few years) to a satellite company to receive retransmitted TV station signals, the modest expenditures required for an over-the-air antenna and associated equipment are plainly reasonable.

Put another way, the Commission has it exactly right in its Notice of Inquiry (at ¶ 6) in stating that households should be expected to "exert similar efforts to receive DTV broadcast

stations as they have always been expected to exert to receive NTSC analog TV signals," including the use of directional rooftop antennas with significant gain.

## IV. RESPONSES TO THE OTHER QUESTIONS ASKED BY THE COMMISSION

The preceding section answers the Commission's first inquiry, namely whether, for purposes of SHVA/SHVERA, the Commission should assume use of a properly oriented rooftop antenna as opposed to an improperly oriented outdoor antenna or an indoor antenna. In this section, we respond to the other specific questions in the Notice of Inquiry.

### A. The Commission's Existing Site Testing Procedures In Section 73.686(d), With Minor Adjustments, Will Work Well For Digital

The Commission has previously developed standardized procedures for measuring analog signal intensity at individual households for purposes of the Satellite Home Viewer Act and successor legislation. *See* 47 C.F.R. § 73.686(d). Those procedures call for signal strength measurements at five locations near the household, with a properly-oriented antenna raised to 30 feet above ground level (for two-story homes) or 20 feet above ground level (for one-story homes).

As discussed below, and as explained in more detail in the Engineering Statement of Meintel, Sgrignoli & Wallace, the Commission's existing methods for measuring field intensity at individual households will -- with a few minor modifications -- work well for digital. (Messrs. Meintel, Sgrignoli & Wallace have collectively performed thousands of digital signal strength measurements, and are therefore in an excellent position to provide guidance to the Commission on this topic.)

The procedures adopted by the Commission for signal intensity testing at individual sites are very similar to those used by engineers around the world for that purpose. MSW Engineering Statement, ¶ 56. With minor adjustments, these procedures will work well for

digital testing as well. Before discussing those adjustments, however, we discuss a special challenge that will have to be confronted in implementing the "digital testing" process. The challenge arises because Congress has postponed -- in some cases by years -- the dates by which certain stations (including virtually all translators) may have their digital signals tested for SHVERA purposes. *See* below. But simply *ignoring* those stations in the testing process would be wrong: it would amount to *performing* the prohibited test (of a nonexistent signal) and finding that the station had failed the test. As more fully explained below, the Commission's rules for digital testing should, until the end of the transition, call for testing of the *analog* signals of any stations that are exempt from digital testing under the Act.

With regard to those stations that *are* subject to digital signal tests under SHVERA, the adjustments required to adapt the existing measurement procedures in Section 73.686(d) to digital testing are as follows:

- **Different minimum signal values**: the signal intensity thresholds (in dBu's) that must be met for a location to be considered "served" are, obviously, different for analog and for digital. Engineers performing signal strength tests must be careful to ensure that they are looking for the correct minimum dBu figure for each station (and in some cases for *analog* minimum dBu levels).

- **No "visual carrier."** The Commission's Notice of Inquiry (¶ 13) correctly points out that there is no visual carrier to be measured in a digital television signal. In response to the Commission's specific question (NOI, ¶ 13), the digital "pilot signal" is *not* a good substitute for the visual carrier in analog testing: the engineer doing the test should not simply measure the pilot power in a narrow band, and then attempt to determine the total power from this value. As Meintel Sgringnoli & Wallace explain, in doing field measurements,

multipath can create sharp peaks and valleys in the pilot signal that could easily cause large measurement errors. (What *should* be measured is discussed below.)

- **Need for different measuring equipment**. As explained in the MSW Engineering report, it will be necessary to use different equipment to measure digital signal strength than the field strength meters used to measure NTSC signal intensity. The Commission defines DTV signals by their *integrated average power* in a 6 MHz bandwidth. *Id.* The instrument used to measure digital field strength must therefore be able to tune to the center of the DTV RF channel and measure this integrated power over 6 MHz. Analog field strength meters cannot do this. MSW Engineering Statement, ¶ 58. As explained by Meintel Sgrignoli & Wallace, however, there are several types of equipment that *can* perform this function. *Id.*, ¶ 59.

- **Need for antenna with substantial gain**. Digital signal testing should be done not with a simple dipole but with a directional antenna with substantial gain, such as the Channel Master 4228. As Meintel Sgrignoli & Wallace explain, use of an antenna with gain helps to ensure that the measured power levels (after line loss) are high enough to permit accurate measurements at all channel ranges. MSW Engineering Statement, ¶ 60.

Since the Commission has assumed that consumers will "exert similar efforts" to receive digital signals as they have always done for analog signals, tests should continue to be conducted at 30 feet (for two-story homes) and 20 feet (for one-story homes). For similar reasons, and as discussed in detail above, the Commission should not permit testing to be done of *indoor* antennas. *See* MSW Engineering Statement, ¶ 61.

### B. As with Analog Testing, Signal Strength Tests are the Best Way to Determine Whether Households Can Receive Digital Signals Over the Air

Next, the Commission asks (NOI, ¶ 14) whether it should recommend use of objective signal strength -- or some other metric -- to determine whether a household can receive an over-

the-air digital signal. As it turns out, empirical data from thousands of site tests show that signal strength is a very good proxy for availability of digital service. (With new improvements in receivers, signal strength will be an even better proxy for digital service in the near future.) Notwithstanding the digital "cliff effect," a digital picture quality test would pose problems similar to those that led both Congress and the FCC consistently (since 1988) to reject a picture quality test for determining whether a household is "served" by an over-the-air analog TV station. As Congress and the Commission have recognized, it is preferable to have a highly reliable -- although necessarily imperfect -- objective standard than a highly "political" and easy-to-abuse subjective standard.

For *analog* television, it is well-established that Grade B intensity is an excellent proxy for the ability to achieve successful reception. More recently, the results of site tests in cities across the United States show that the FCC's minimum digital strength values (such as 41 dBu for Channel 38) are an excellent proxy for successful *digital* reception.

As explained in the Engineering Statement of Meintel, Sgrignoli & Wallace, engineers have conducted thousands of field tests -- in 15 separate measurement programs across 12 different cities – to evaluate both (i) whether the ambient *field strength* was above the FCC-specified minimums and (ii) if so, whether it was possible to achieve successful *reception* at that location. MSW Engineering Statement, ¶ 64. Engineers developed a statistic called the "System Performance Index": the percentage of sites with signal levels above the FCC-defined minimums that also successfully achieved DTV reception. In essence, this statistic measures how well digital signal strength functions as a proxy for the ability to receive a high-quality picture.

Importantly, the "System Performance Index" percentages achieved in the tests done from 1994 through 2001 are undoubtedly much *lower* than would be achieved if the same tests were done today. The reason is that the receivers used for the tests done from 1994-2001 were much less sophisticated than later generations of receivers, and in particular than the much-improved fifth generation receivers, which do far better at resolving difficult multipath problems. *See* MSW Engineering Statement, ¶¶ 65-66. Since DIRECTV and EchoStar can easily incorporate higher-quality receiver chips into their set-top boxes going forward, the real-world System Performance Index figures will be even higher in the future.

In any event, *even with relatively low-quality, now-obsolete receivers*, the average System Performance Index across the 15 digital testing programs was 90%. MSW Engineering Statement, ¶ 68. In the small minority of instances in which ambient digital field strength was above threshold but successful reception was not achieved, the causes are usually multipath or interference problems. *Id.* But since the latest generation of receivers do so much better at handling difficult reception environments, even this low rate of reception problems will decline substantially during the period (starting in May 2006) when digital testing is authorized for purposes of SHVA/SHVERA.

NAB anticipates that some commenters may urge use of a "picture quality" test instead of a signal strength test. While it is true that a small group of highly-trained and experienced engineers have both measured field strength *and* evaluated digital picture quality for purposes of evaluating competing digital television systems (such as 8-VSB vs. COFDM),[17] **evaluating**

---

17 In the testing done in Charlotte for the Grand Alliance, engineers evaluated the picture quality achieved with *analog* signals. Nevertheless, the SHVA provides for a strictly objective signal strength test for over-the-air analog reception. The fact that picture quality tests are done

**whether digital reception has been achieved by watching the picture on a screen nevertheless requires subjective judgments.** As Meintel, Sgrignoli & Wallace explain, while a DTV set often displays a blank (or blue) screen when there is a reception problem, at times a DTV picture may suffer from "blockiness" or sometimes a freeze frame. MSW Engineering Statement, ¶ 70. While a small group of highly-trained engineers have counted such "impairments" in tests conducted during the digital planning process, determining whether a momentary event counts as an "impairment" is necessarily a subjective assessment, just as with analog television. *Id.*

To complicate matters further, DTV receivers often use "error concealment" (such as repeating information from the previous frame) that can hide the errors on static portions of the picture -- so that the "lost packets" may or may not be visible on the screen. *Id.* For all of these reasons, assessing whether the picture is "flawed" at a given moment, and counting the total flaws, calls for subtle and complicated judgment calls. *Id.*

Because the results of field testing by experienced engineers show that objective signal strength is an excellent proxy for the availability of a high-quality digital picture, there is no *need* for such subtle judgments to be made in field testing at individual households for purposes of SHVA/SHVERA. And there is no way that such difficult subjective judgments could be made neutrally and accurately -- much less consistently -- by a wide variety of testing personnel around the country, with far less experience in making such judgments, and often with the homeowner standing nearby urging the tester to give the picture a "bad grade" so that the household will be deemed unserved. Since objective signal strength is such a good proxy for

---

by engineers in evaluating a television delivery method therefore does not mean that a picture quality test should be done in the field for testing individual households.

successful reception -- even with early-generation receivers -- the Commission should continue to rely on objective signal strength as the legal standard. It should reject a *subjective* standard, which the DBS industry used in the 1990s to sign up millions of illegal subscribers for distant signals.

While there exists an additional *objective* method (beyond signal strength) that could be used to evaluate picture quality, the Commission should not endorse it: as Meintel Sgrignoli & Wallace explain, this method is highly complex and requires specialized equipment. MSW Engineering Statement, ¶¶ 72-73.

### C. The Longley-Rice Model Is Very Accurate At Predicting Whether Signal Strength At Particular Locations Is Above Or Below DTV Minimums, But There Are Practical Issues About Use Of A "Digital ILLR" Model For SHVERA Purposes

In principle, the Longley-Rice model does an excellent job of predicting whether particular locations can receive a signal above the DTV minimums. And should it be necessary -- after the digital transition is complete -- to predict whether particular households can receive DTV signals, the Longley-Rice model is the best candidate for that task. (Of course, there may be no need to do that, because digital local-to-local may be universal at that point.)

Despite Longley-Rice's demonstrated excellence as a predictive model, in the ***short run***, there are serious concerns about allowing DBS companies to use Longley-Rice as a basis for delivering distant digital signals based on the claimed absence of a digital signal over the air. These concerns arise, for example, from the fact that very few translator stations have channel assignments, much less fully functioning facilities, and that many full-power stations will not be subject to digital testing until July 2007 or later. These concerns no doubt lie behind Congress' decision not to permit DBS companies to serve subscribers based on a prediction about the lack of an over-the-air digital signal. In the interim, however, satellite companies can rely on the

*analog* ILLR model to deliver distant digital signals to subscribers who are predicted to be unable to receive an analog station affiliated with the relevant network.

### 1. The Results of Thousands of Digital Signal Tests Show that Longley-Rice is a Highly Accurate Model

In its Notice of Inquiry, the Commission states that the Longley-Rice model is "an accurate, practical, and readily available model for determining signal intensity at individual locations when used with analog signals." (NOI, ¶ 15). That conclusion is amply justified: as the data developed in the Commission's prior SHVA proceedings attests, Longley-Rice has an excellent track record of predicting whether particular locations receive a signal above Grade B intensity.

As detailed in the Engineering Statement of Meintel, Sgrignoli & Wallace, a similar conclusion applies to use of Longley-Rice to predict digital signal strength. In recent years, engineers have performed thousands of digital signal intensity tests in 12 different U.S. cities. Meintel, Sgrignoli & Wallace have analyzed these digital data using the same principle the Commission applied in analyzing analog data in its 2000 ILLR Order: that is, they compared the Longley-Rice *predictions* for these locations with the actual *measured signal strength* for the same locations. In each case, the question was whether the prediction -- or the measurement -- was above or below the noise-limited contour values specified in the Commission's rules for DTV signals.

These real-world empirical data show that the Longley-Rice model does very well when judged against actual measurements of digital signal strength. Across all channel bands, Longley-Rice correctly predicted 94.4% of the time that the signal would be above (or below) the DTV minimum. MSW Engineering Statement, ¶ 76. Indeed, the relevant percentage is even higher -- 96.9% -- if one includes instances of *underprediction*, where the Longley-Rice model